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**THE GENUS *MIMOSA* WITH SPECIAL REFERENCE TO *M. QUADRIVALVIS*
L. VAR. LEPTOCARPA (D.C.) EARNEDY, A NEW SPECIES RECORD FOR
THE WEED FLORA IN MALAYSIA^{*)}**

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ABSTRACT

An exploratory floristic survey of the genus *Mimosa* was conducted in 1993 to ascertain species diversity and their spatial patterns of distribution in Peninsular Malaysia. A new species record of uncertain indigene, *M. quadrivalvis* was recorded for the first time in restricted localities along the roadsides in Pekan Darat and Bertam, Seberang Perai, Gurun and Bedong in Kedah in addition to widely distributed and seemingly ubiquitous presence of *M. invisa* Mart. ex. Colla and *M. pudica* L. The latter two species were mostly found in open, disturbed and derelict habitats, agricultural areas and ex-mining lands. Both species exhibited largely contagious and overdispersed distribution patterns with positive peaks in pattern intensity values although regularity or underdispersed distribution patterns do manifest in certain localities. The giant mimosa, *M. pigra* inhabited in clustered thickets, large pockets of lands in the urban and sub-urban localities in the states of Penang, Perak, Kelantan, Kuala Lumpur and Negeri Sembilan. In other states, *M. pigra* was confined to a few localities in smaller patches. Except for *M. quadrivalvis*, the other species of *Mimosa* are serious weeds in the agricultural, recreational and residential and derelict areas. A key to the *Mimosa* species is constructed along with brief descriptions on their morphology and ecology.

Key words: Malaysia/Weed ecology/*Mimosa invisa*/*Mimosa pigra*/*Mimosa pudica*/*Mimosa quadrivalvis*/ Weed distribution/Weed anatomy and morphology.

INTRODUCTION

The genus *Mimosa*, in the family Mimosaceae (syn. Leguminosae or Fabaceae) is large and cosmopolitan with 300-500 species worldwide (Holm *et al.* 1977; Nielsen 1981, 1983, 1992). The intricacy of this genus has made it a subject of continued research interest and taxonomic revisions (e.g. Ridley 1925; Corner 1952; Henderson 1959; Burkill 1966; Metcalfe & Chalk 1972; Nielsen 1992). According to Index Kewensis (1991), there are well over 1800 binomials of *Mimosa* worldwide with heavy concentrations in tropical America. In Malesia, there are three introduced and naturalised species. Recent studies by Nielsen (1992) gave extensive accounts of the genus

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on the world scale. In Malaysia, the genus *Mimosa* is known for its weedy elements viz. *M. invisa*, *M. pigra* and *M. pudica* infesting large areas of agricultural, residential, recreational, roadsides and derelict areas and ex-mining lands. Ridley (1925) gave the first account of the family in the Malay Peninsula while Burkill (1966) described a brief history of the various species that has been introduced into the Malay Peninsula. Waterhouse (1993) enlisted the three weedy species of *Mimosa* with the 15 to 19 ratings among the 140 most important weed species as appropriate targets for biological control in Southeast Asia in general and in Malaysia in particular.

This paper reports briefly on the morphology and distribution patterns of *Mimosa* spp. with emphasis on *M. quadrivalvis* L. var. *leptocarpa* (DC.) Barneby.

MATERIALS AND METHODS

An exploratory floristic survey was conducted in 1993 in Peninsular Malaysia to ascertain species diversity and spatial distribution patterns of the genus *Mimosa*. For such purpose, samplings were made at random in selected vegetable gardens, derelict areas, immature rubber and oil palm estates, ex-mining lands and roadsides. In addition, the list count quadrat (1m x 1m) method of Kim & Woody (1983) was also used. In the case of *M. pigra*, the line transect method was used with quadrat size of 2m x 2m. Only adjacent and accessible areas close to the roads were sampled. A total of 72 quadrat samples for each species were obtained (Table 1). The spatial distribution data for each species were subjected to pattern analysis (Allinson 1981) with pattern intensity values used as indices to measure the departure from randomness. Detailed morphological comparisons were made between species.

Table 1. Plot size, number of transects and quadrats transects employed in pattern analysis of plant population of *Mimosa* species

Species	Plot size (m)	No. of transects	No. quadrat/transect
<i>M. invisa</i>	1 x 1	12	6
<i>M. quadrivalvis</i>	1 x 1	12	6
<i>M. pigra</i>	2 x 2	12	6
<i>M. pudica</i>	1 x 1	12	6

RESULTS AND DISCUSSION

Pattern of distribution

Figure 1 illustrates the extent of infestation of the four species of *Mimosa* in Peninsular Malaysia. Generally, heavy concentrations of *M. pigra* are found in ex-mining lands, ex-padi farms and derelict areas both in rural and urban localities in the states of Penang, Perak, Kelantan, Kuala Lumpur and Negeri Sembilan, often in clustered thickets and large pockets. *Mimosa invisa* and *M. pudica* are widely distributed and seemingly ubiquitous mostly in open, disturbed and derelict habitats, agricultural areas and ex-mining lands. The soils range from rather wet of the inceptisol, vertisol and entisol types or the relatively dry soils of the oxisol or ultisol types. Soil samples taken in areas where rampant infestations of *Mimosa* spp. occur registered pH values ranging from 4.0 - 5.0. *Mimosa invisa* and *M. pudica* are also found on the bris soil habitat in Terengganu, Pahang, Kelantan and Pantai Remis areas of Perak.

Clump sizes of adult populations vary considerably according to the species of *Mimosa*. In the case of *M. pigra*, it ranges from 1.0 m to 6 m in diameter while for *M. pudica* and *M. invisa* these were about 0.25 m - 2.0 m. *Mimosa quadrivalvis* has a relatively smaller clump size of about 0.2 - 1.0 m (Table 2). Genet populations range from 0.2 - 1.0 plant/m² for *M. pigra*; 0.5 - 4.0 plants/m² (*M. invisa* and *M. pudica*) to 1.0 - 5.02 plants/m² for *M. quadrivalvis*, thereby emphasizing different morphology and growth habits of the different species of *Mimosa* (Table 2).

Table 2. Clump size and genet population density of *Mimosa* spp. in Peninsular Malaysia

Species	Clump size (m)	Genet population density (per m ²)
<i>M. invisa</i>	0.25 - 2.0	0.5 - 4.0
<i>M. quadrivalvis</i>	0.20-1.0	1.0-5.0
<i>M. pigra</i>	1.0 -6.0	0.2-1.0
<i>M. pudica</i>	0.25 - 2.0	0.5 - 4.0

The spatial distribution of the four species of *Mimosa* differed accordingly, showing *pattern* at different block sizes in different regions of survey. In the case of *M. pigra* population in the northern states of Penang, Perak and Kedah (Region a), *pattern* was observed with peak pattern intensity values at block size 12. Similar clusterings were observed among *M. pigra* populations in Malacca, Negeri Sembilan, Johore (Region c) and Kelantan (Region d). *Mimosa pigra* populations in the Federal Territory,

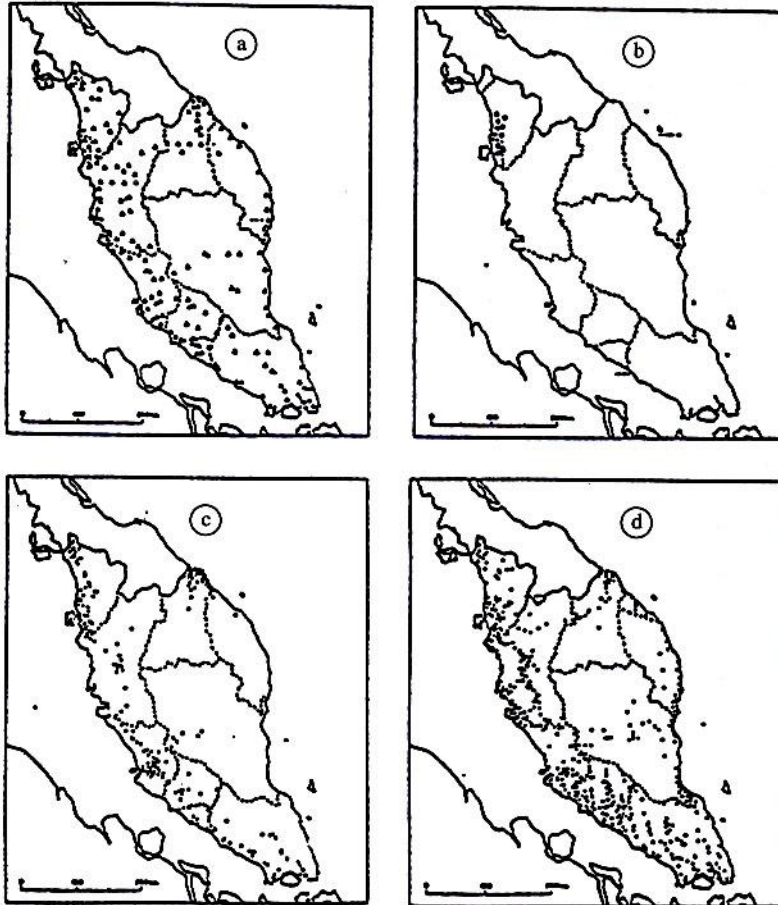


Figure 1. The distribution of (a) *Mimosa invisa*, (b) *M. quadrivalvis*, (c) *M. pigra*, and (d) *M. pudica* in Peninsular Malaysia. Each symbol represents at least one record within 5 m radius.

Selangor (Region b) and southern Perak showed *pattern* at block sizes 8 and 16. A tendency towards *regular* undispersed spatial distribution was observed among *M. pigra* populations in Region b at block size 1 (Figure 2a).

Individual genets among *M. invisa* population for all regions showed *regularity* for block sizes 1, 2 and 3. Contagious overdispersed individuals were observed at block size 6 for Region c and block size 8 for Regions a, b and d (Figure 2b).

Regularity in spatial distribution of individuals of *M. pudica* was recorded at block sizes 1, 2 and 3 for all Regions saved Region b. Positive peaks of pattern intensity values were recorded at block size 6 for Regions a, b and d and block sizes 6 and 16 for Region c (Figure 2c).

The spatial distribution of individual genets of *M. quadrivalvis* showed *pattern* at block size 6 but exhibited *regularity* at block sizes 1, 2 and 3 (Figure 2d).

No concrete arguments can be forwarded to explain the spatial heterogeneities exhibited by different populations of *Mimosa pigra*, *M. invisa*, *M. pudica* and *M. quadrivalvis*. Differential growth rates and differences in morphology among the species studied are too simple a notion to help illustrate such differences. Further analyses on the possible roles of environmental variables such as soil, pH, nutrient status, soil types, etc. in explaining the spatial heterogeneities and distribution patterns of the different *Mimosa* species are needed.

Morphology and Species Description

Morphological illustrations and habit of *M. quadrivalvis* are shown in Figures 3 -6. Comparative morphological traits and characteristics of the species are shown in Tables 3 and 4.

1. *Mimosa invisa* auct. non Mart, ex Colla: Backer & Bakh. f., Fl. Java 1 (1963) 561; Burkill, Diet. Econ. Prod. Mal. Penins. 2 (1966) 1498; Nielsen, Fl. Camb., Laos, Vietnam 19 (1983) 34, pi. 5: 1-7; Nielsen, Fl. Malesiana ser. 1, 2, 1 (1992) 184-185.

A procumbent perennial shrub, growing up to 3 m high. Stem conspicuously 4-angled, up to 4 m long, densely distributed with prickles. Leaves bipinnate, primary leaflets 4 to 9 pairs, leaflets opposite sessile 12 to 30 pairs, lanceolate, 6 to 12 mm long, 1.5 mm wide. Inflorescence a globular head, axillary, flowers pinkish violet, corolla 4-lobed with 8 pinkish violet exerted stamens. Fruit softly spiny, 3- to 4-seeded borne as clustered axillary, flattened pods, 1.0 to 3.5 cm long, 6 to 10 mm wide, splitting along the valves into 1-seeded segments when mature. Seeds flattened, ovate light brown, rather glossy, 2 to 3 mm long.

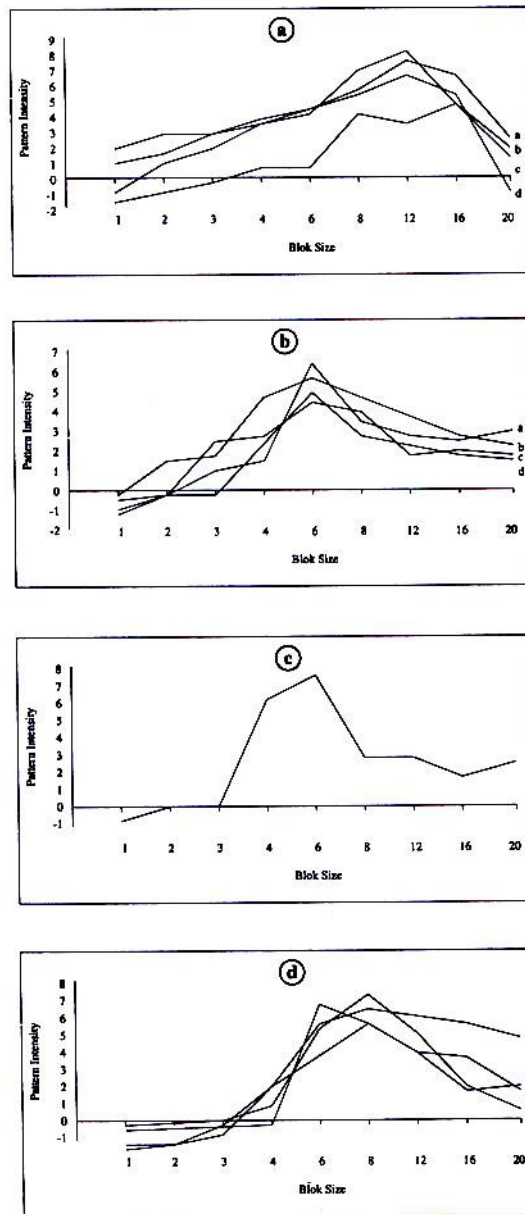


Figure 2. Pattern intensity values of spatial distribution of (a) *M. pigra*, (b) *M. invisa*, (c) *M. quadrivalvis*, and (d) *M. pudica* plants at different block sizes. Lower case letters on the curve denote regions of occurrence (see text for details).

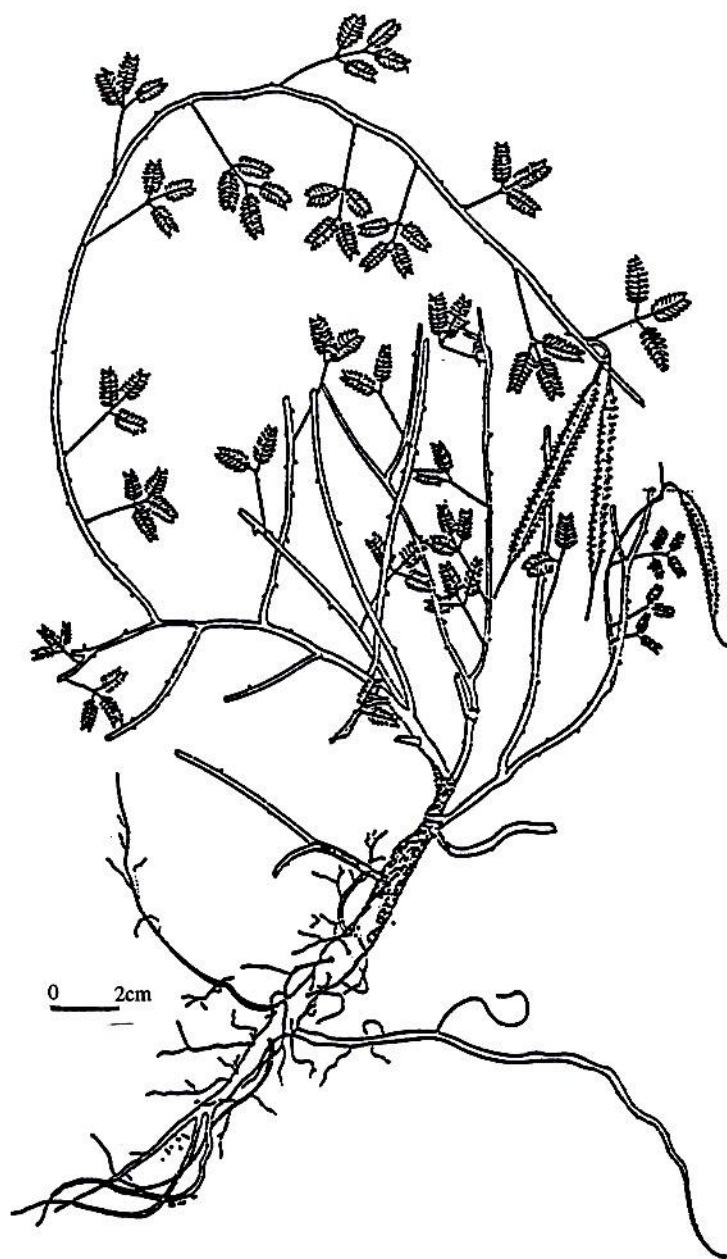


Figure 3. *Mimosa quadrivalvis*.

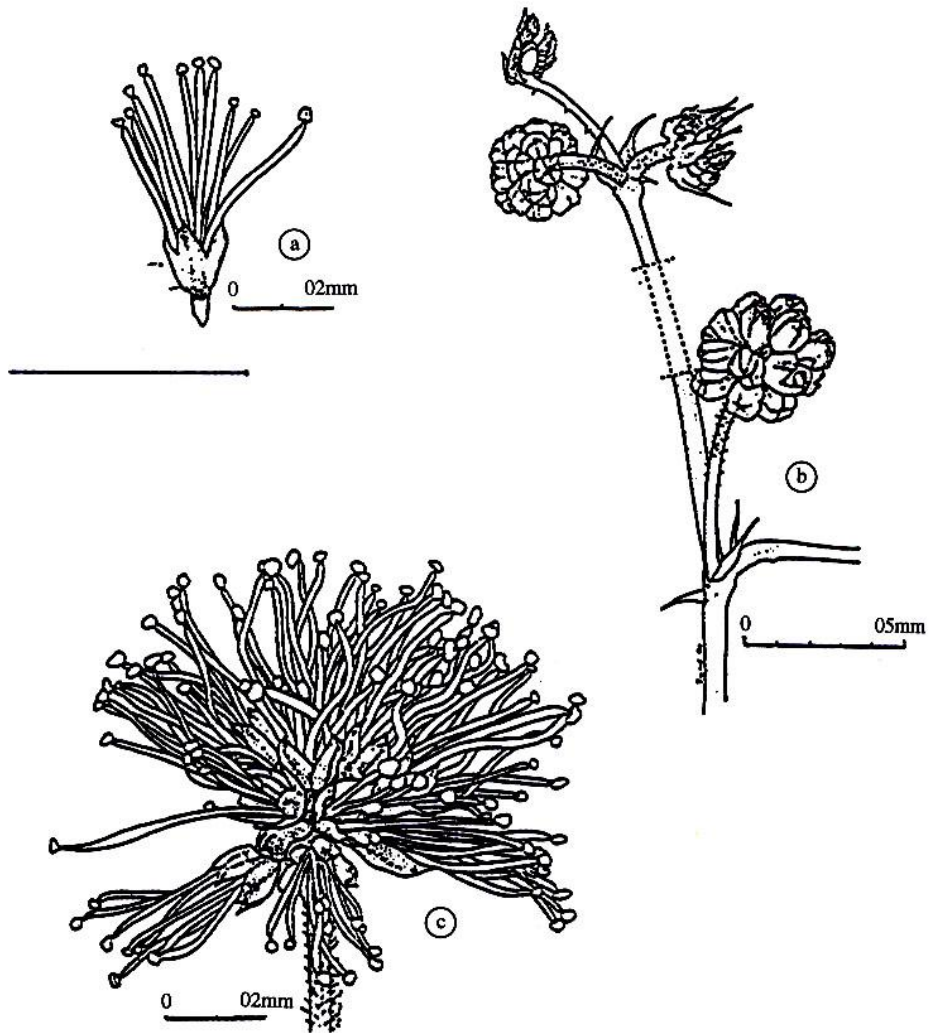


Figure 4. *Mimosa quadrivdivis*. (a) stamens, (b) axillary inflorescence, (c) opened flowers.

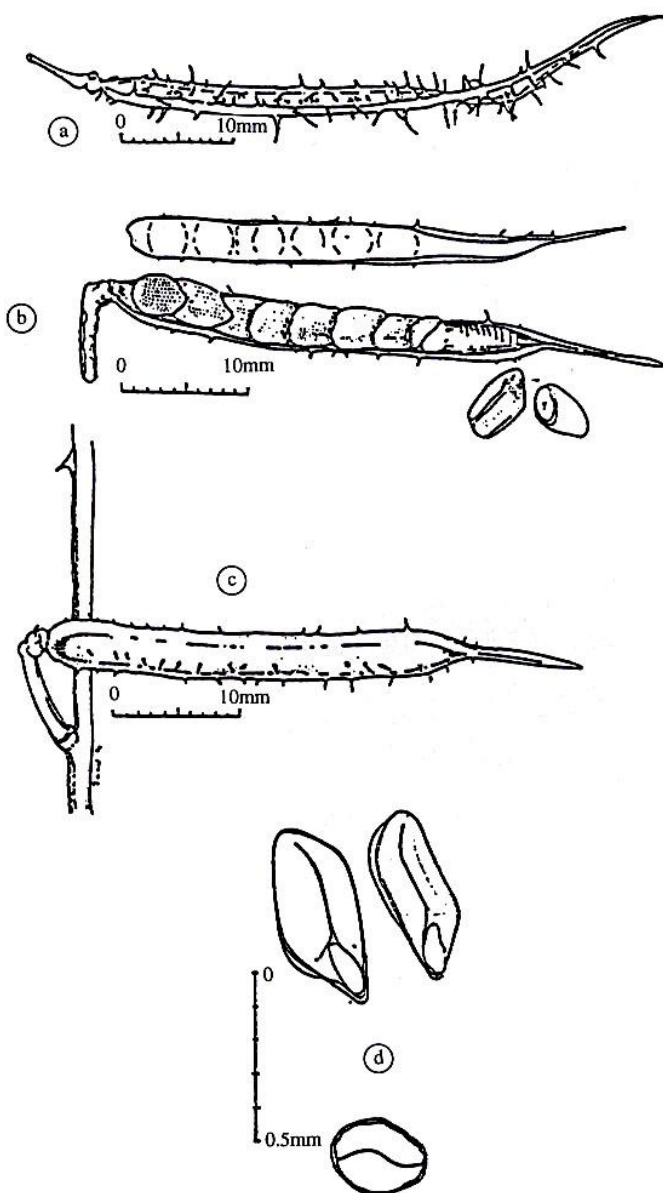


Figure 5. *Mimosa quadrivalvis*. (a) mature pod densely covered with long, fine prickles, (b) opened pod, (c) young pod, (d) seeds.

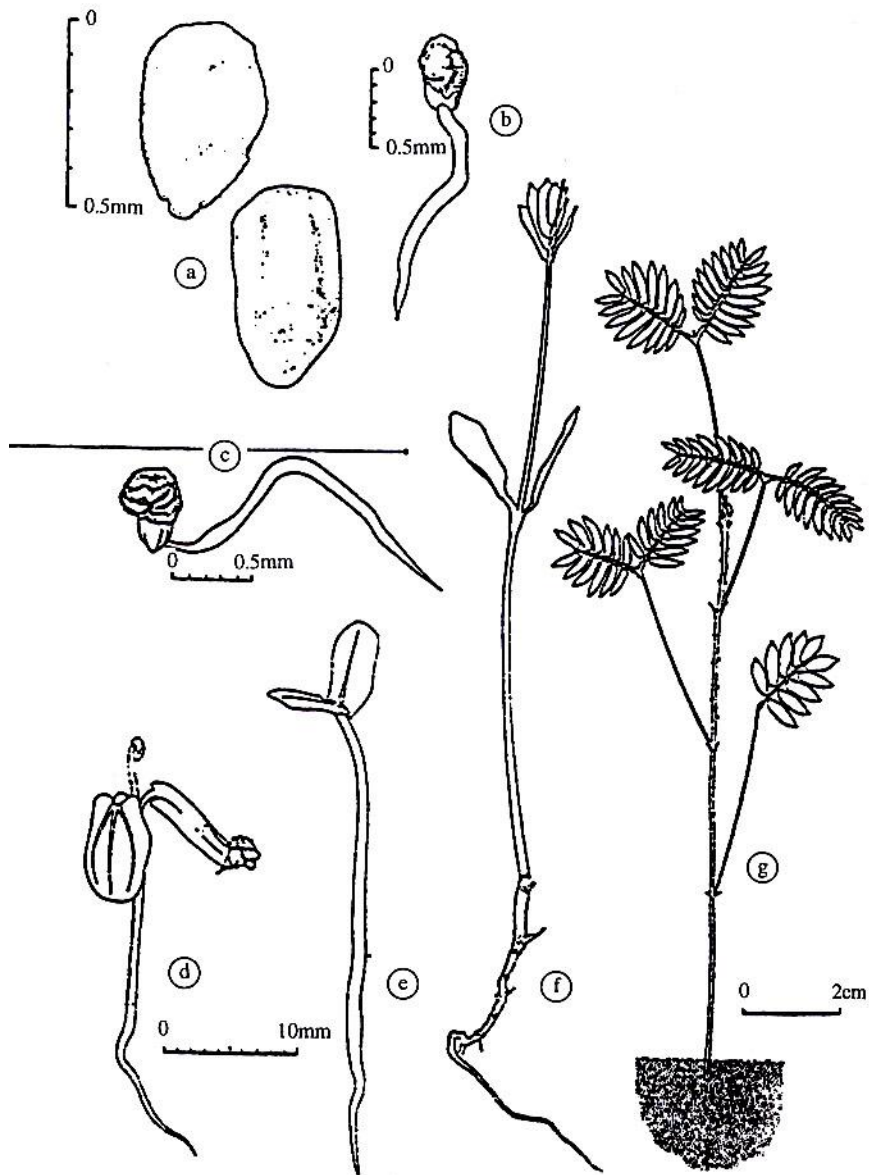


Figure 6. *Mimosa quadrivalvis*. (a) seeds, (b & c) emergence of hypocotyl, (d & e) hypocotyl with cotyledons, (f) emergence of once-pinnate, first true-leaf, (g) young plant.

Table 3. Comparative morphological traits of four selected species of *Mimosa*

Morphological traits	Species			
	<i>M. invisa</i>	<i>M. quadrivalvis</i>	<i>M. pigra</i>	<i>M. pudica</i>
Leaf	Bipinnate, primary leaflets 4-9 pairs, leaflets 12-30 pairs, lanceolate, 6-12 mm long, 1-5 mm wide	Bipinnate, primary leaflets 1-2 pairs, leaflets 9-16 pairs, oblanceolate-oblong, pubescent, 2-8 mm long, 0.5-2 mm wide	Bipinnate, primary leaflets about 15 pairs, leaflets lanceolate	Bipinnate, primary leaflets 1-2 pairs, leaflets 12-25 pairs, oblong or linear, 9-12 mm long, 1.5 mm wide, margins hairy
Stem	Conspicuously 4-angled, densely distributed with prickles	Angular but slightly rounded at younger age	Woody, sparsely distributed with prickles	Rounded, stiff, prickles scattered along internodes
Root	Branching taproot, extending to 1-2 m	Slightly woody, branched taproot	Branching taproot, extending 1-2 m	Slightly woody, branched taproot
Flowers	In globular heads, axillary, pinkish violet, corolla 4-lobed, stamens 8, pinkish violet	In globular heads, axillary, pinkish stamens numerous, pinkish	In globular heads, axillary, pink or mauve, corolla 4-lobed, stamens 8, pink	In ovoid or globular heads, axillary, purplish pink, corolla 4-lobed, stamens 4, purplish pink
Fruits/Pods	Softly spiny, 3- to 4-seeded, flattened pods, axillary, 1.0-3.5 cm long, splitting into 1-seeded segments	Axillary flattened pods, covered with prickles, 4.0-9.5 cm long, apex sharply pointed, tapered to a point 1.0-1.5 cm long	Axillary flattened pods, densely hairy, 6.5-7.5 cm long, breaking into 1-seeded segment	Axillary flattened pods, oblong, 1-2 cm long edge with prickles, breaking into 1-seeded segments
Seeds	Flattened, ovate, light brown, glossy, 2-3 mm long	Ovate to rhomboid, brownish-black, about 3 mm long	Flattened, oblong, brown or olive green, 4-6 mm long	Flattened with a finely granular surface, light brown, 2.5-3 mm long
Seedling	First true leaf deeply divided into several opposite leaflets	Emerge as a single stem carrying cotyledons and a once-pinnate, first true-leaf	Emerge as a single stem carrying cotyledons and a deeply divided, once-pinnate, first true-leaf	Emerge as single stem bearing cotyledons and the once-pinnate first true leaf

Table 4. Comparative selected characteristics of four selected species of *Mimosa*

Life-history characteristics	Species			
	<i>M. invisa</i>	<i>M. quadrivallis</i>	<i>M. pigra</i>	<i>M. pudica</i>
Habit	procumbent/shrub	procumbent creeping/shrub	erect woody shrub	procumbent creeping/shrub
Habitat	shady tolerant to fully exposed areas; many soil types	open, exposed, lateritic soils	open, exposed; podsolic, alluvial soils	shady-exposed; many soil types
Life cycle	perennial	perennial?	perennial	perennial
Phenology	flowers all year around	?	flowers all year around	flowers all year around
Breeding system	self-compatible	self-compatible	self-compatible	self-compatible
Fecundity	1200 seeds/plant/yr	?	95 000 seeds/plant/yr	>700 seeds/plant/yr
Growth strategies	C-S	S-R	C-S	C-S
Major causes of mortality	predation, density, seed decay	?	predation, pathogens, density, seed decay	predation, pathogens, density, seed decay

C=competitive; S = stress tolerant; R = ruderal

2 *Mimosa quadrivalvis* L. var. *leptocarpa* (DC.) Barneby.

A straggling shrub. Mature stem angular, prickles sparsely distributed; younger stem slightly rounded. Leaves evenly bipinnate, primary leaflets 1 - 2 pairs, 0.5 - 1 cm apart from each other, leaflets opposite, 9-16 pairs, almost sessile, 2 - 8 mm long, 0.5 - 2.0 mm wide, margin entire, pubescent, oblanceolate-oblong, both abaxial and adaxial surfaces sparsely distributed with glands and sparsely hairy but abaxial surface of outermost leaflet usually more hairy compared to abaxial surface of the inner leaflets. Secondary veins obscure, apex mucronate-truncate, base truncate. Secondary rachilla covered with short fine hairs, sparsely distributed. Inflorescence a globular head, axillary, 18 - 20 flowers per inflorescence. Stamen numerous, pinkish, 1.0 - 1.5 mm long, arranged in several rows forming a globular head. Bracts present, hairy. Fruits in axillary flattened pods, 1 - 3 in a group, usually the third one abortive, 4.0 - 9.5 cm long with prominent raised ridge along the edges, apex sharply pointed, tapered to a point 1.0 - 1.5 cm long, almost linear, moderately to densely covered with long, fine prickles, pedicel 0.8 - 1.1 cm long, hairy; mature fruits dehisce along sutures. Seed ovate to rhomboid in shape when dry, brownish-black, about 3 mm long.

3. *Mimosa pigra* L., Backer & Bakh. f., Fl. Java 1 (1963) 561; Nielsen, Fl. Camb. Laos, Vietnam 19 (1981) 34, pi. 5: 8-14; Nielsen, Fl. Malesiana ser. 1, 2, 1 (1992) 185.

Mimosa sepia auct. non Benth.: Ridley, Fl. Mal. Pen. 1 (1922) 656, p.p.; Burkill, Diet. Econ. Prod. Mal. Pen. 2 (1966) 1499.

An erect, perennial woody shrub, growing up to 5 m high. Stem woody, up to 3 m long, sparsely distributed with prickles. Leaves bipinnate, primary leaflets about 15 pairs, leaflets sessile, lanceolate. Inflorescence a globular head, axillary, flowers pink or mauve, corolla 4-lobed with 8 pink stamens. Fruits densely hairy, 20- to 25-seeded axillary, borne as clustered flattened pods, 6.5 to 7.5 cm long, 7 to 10 mm wide, breaking into 1-seeded segments when mature. Seed brown or olive green, oblong, flattened, 4 to 6 mm long, 2 m wide.

4. *Mimosa pudica* L., Backer & Bakh. f., Fl. Java 1 (1963) 561; Nielsen, Fl. Camb. Laos Vietnam 19 (1981) 35, pi.; Nielsen, Fl. Malesiana ser. 1, 2, 1 (1992) 185-186.

A procumbent, perennial, creeping shrub growing up to 50 cm high. Stem rounded, stiff, up to 150 cm long, prickles scattered along the internodes. Leaves bipinnate, primary leaflets 1 to 2 pairs, leaflets opposite, 12 to 25 pairs, oblong or linear, 9 to 12 mm long, 1.5 mm wide, margins hairy. Inflorescence an ovoid or a globular head, borne on prickly axillary stalks, flowers purplish pink, corolla 4-lobed, stamens 4, purplish pink. Fruits oblong, flattened 1- to 5-seeded pod, 1 to 2 cm long, 3 to 6 mm wide, edge with prickles, borne in cluster on leaf axils, breaking into 1-seeded segments

when mature. Seeds light brown, flattened with a finely granular surface, 2.5 to 3 mm long.

Key to *Mimosa* species in Peninsular Malaysia

1. Primary leaflets 1-2 pairs
 2. Leaflets almost sessile, pubescent, 2 - 8 mm long, 0.5 - 2.0 mm wide. Stem angular. Flowers pink, in globular heads, stamens pink. Pods 4.0 - 9.5 cm long, apex sharply pointed tapered to a point 1.0 - 1.5 cm long, covered with long, fine prickles *M. quadrivalvis*
 2. Leaflets sessile, 9 - 12 mm long, 0.5 mm wide, margin hairy. Stem rounded. Flowers purplish pink, in ovoid or globular head, stamens purplish pink. Pods 1 - 2 cm long, edge with prickles *M. pudica*
1. Primary leaflets more than 2 pairs
 3. Primary leaflets 4 - 9 pairs, leaflets lanceolate. Stem conspicuously 4-angled with numerous prickles. Flowers pinkish violet. Pods 1.0 - 3.5 cm long, 3 to 4-seeded. Seed light brown, glossy, ovate, 2 - 3 mm long *M. invisa*
 3. Primary leaflets about 15 pairs, leaflets lanceolate. Stem woody, prickles sparsely distributed. Flowers pink or mauve. Pods 6.5 - 7.5 cm long, 20- to 25-seeded. Seeds brown or olive green, oblong, 4 - 6 mm long *M. pigra*

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